A Comparison of

Crossbred Cows

For Feeder Calf Production

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INTRODUCTION

Commercial production of feeder calves is the most common beef enterprise in Arkansas. Approximately 50,000 farmers produce some one million feeder calves each year.

During the past two decades numerous studies have shown production advantages for F_1 crossbred cows and 3-breed cross calves. Crossbred matings offer the opportunity to create desirable combinations of traits and to take advantage of heterosis. The advantages realized from these opportunities vary depending on breeds that are crossed. Direct comparison under Arkansas conditions of maternal performance of F_1 crossbred cows provides information of interest and value to producers either breeding or purchasing crossbred female replacements.

The primary objective of this experiment was to compare various kinds of F_1 crossbred cows for feeder calf production. Secondary objectives were to compare certain terminal sire breeds under conditions of competitive mating.

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METHODS

Analyses of two data sets are reported in this publication. Both were taken from calves weaned at the Southwest Research and Extension Center near Hope, Arkansas. They consist of records of birth weight, weaning weight, weaning grade and condition scores. Feeder calf grades were based on the USDA grading system used in 1975. These records were taken at weaning, which was either the last week of July or the first week of August each year, for calves born in the fall of the previous year. Calving dates were mostly in October and November with a few calves born in September and December.

The first data set contained observations for calves weaned in 1975, 1976, 1977 and 1978. In this four year sequence, calves were from five F_1 breed of dam groups and two sire breeds. The F_1 dam breed groups were Angus x Brahman (ABR), Angus x Red Poll (ARP), Angus x Hereford (AH), Hereford x Brahman (HBR) and Hereford x Red Poll (HRP). Except for the AH group, which was approximately equal in numbers of Hereford x Angus and Angus x Hereford, the dam breed is listed first. For example ABR indicates a cow that was the result of mating a Brahman bull to an Angus cow. Sire breeds to which the crossbred cows were mated were Charolais (CH) and Santa Gertrudis (SG). The number of calves produced by each kind of F_1 cow and by each sire breed is shown in Table 1.

Table 1. Number of Observations According to Breed of Sire and Breeding Group of Dam, 1975-78 (Data Set 1)

Breeding Group of Dam	Breed of Sire CH	SG	Total
ABR	28	14	42
ARP	52	16	68
HA & AH	46	14	60
HBR	28	14	42
HRP	41	8	49
Total	195	66	261

Management of the cattle was in conjunction with forage studies in which four, fifty acre pastures were established that were approximately half common bermudagrass and half tall fescue overseeded with white clover. The four pasture management regimes differed in the timing of fertilizer applications. To minimize the effect of pasture differences, four herds of 25 cows each were established and rotated each year among the pastures so that over a period of four years all herds grazed all pastures for one grazing season.

The herds were established from heifers of known genetic composition, born and reared as contemporaries in Arkansas Agricultural Experiment Station herds. In the few cases where cows were lost or removed from a herd, they were replaced with cows of the same breed composition. Each of the herds consisted of five cows of each F_1 breed combination.

During a breeding season from December 1 to March 1, a CH bull and an SG bull were run with each herd and allowed to competitively mate under pasture conditions. Bulls were paired on the basis of age, weight and gain records in so far as possible. Each year a herd was exposed to a different pair of bulls. Sire of calf was determined visually at birth.

The second data set was obtained from the calves weaned in 1979, 1980, 1981 and 1982. In this four year sequence, calves were from nine F_1 breed of dam groups and two sire breeds. The F_1 dam breed groups were the five breed combinations in data set 1, and in addition, Angus x Charolais (ACH), Hereford x Charolais (HCH), Angus x Santa Gertrudis (ASG) and Hereford x Santa Gertrudis (HSG). Sire breeds used under the conditions of competitive mating were Brangus (BN) and Simmental (SI). The number of calves produced by each kind of F_1 cow and each sire breed in data set 2 is shown in Table 2.

Table 2. Number of Observations According to Breed of Sire and Breeding Group of Dam, 1979-82 (Data Set 2)[1]

Breeding Group of Dam	Breed of Sire: BN	Breed of Sire: SI	Total
ABR	26 (26)	42 (33)	68 (59)
ACH	25 (20)	43 (38)	68 (58)
ARP	26 (21)	34 (31)	61 (52)
ASG	26 (25)	39 (32)	66 (57)
HA & AH	15 (15)	30 (26)	45 (41)
HBR	22 (19)	43 (37)	65 (56)
HCH	18 (14)	43 (38)	61 (52)
HRP	21 (16)	41 (37)	62 (53)
HSG	16 (15)	41 (36)	57 (51)
Total	195 (171)	356 (308)	551 (479)

[1]No grade and condition scores were taken in 1982. The number in parenthesis is the number of grade and condition scores available for analysis.

Management of the cattle in data set 2 was similar to and on the same pastures as that of data set 1. The data sets differed in that stocking rates and pasture fertilization rates were increased in data set 2. Each herd consisted of 45 cows (5 cows of each F_1 combination) grazing the 50 acres allotted. Rotation of the herds among the pastures again followed a plan so that all herds would graze all pastures over a period of four years.

In order to fairly compare the sires and dams in these analyses, it was necessary to standardize the records for age of calf, sex, and age of dam. Correction factors developed from combined data sets and other similar cattle on the station by least squares procedures (Harvey, 1975) are in Table 3. Data were adjusted to 240 days of age and the population mean for sex and age of dam using the values indicated in Table 3. The correction factors were based on 1392 observations of birth weight, 1390 observations of weaning weight, and 1297 observations of weaning grade and condition.

Table 3. Least-Squares Estimates of the Effects of Sex, Age of Dam and Age of Calf on Birth Weight, Weaning Weight, Grade and Condition Used in Standardizing the Data

Source of Variance	Birth Weight[a] (lb.)	Weaning Weight[a] (lb.)	Grade[a]	Condition[a]
Sex[b]				
Heifer	−2.9	−25.3	−.2	−.07
Steer	2.9	25.3	.2	.07
Age of Dam[b]				
≤ 3 years	−3.6	−16.4	−.07	.17
4	.6	9.8	−.01	.06
5	1.3	9.5	.18	.06
6	2.3	23.1	.06	.08
7	2.0	22.7	.04	.08
8	.6	3.3	.16	.00
9	−.6	−6.4	−.05	−.14
10	−1.0	−16.2	−.02	−.04
≥ 11	−1.6	−29.4	−.28	−.27
Age of calf[c]				
Change per day of age	---	.9	.01	.002

[a]There were 1392 observations for birth weight, 1390 observations for weaning weight, and 1297 observations for grade and condition scores.
[b]Data were adjusted for sex and age of dam by reversing sign and adding to actual measurement.
[c]Data were adjusted to 240 days of age by multiplying these factors by the deviation in days from 240 and adding or subtracting as appropriate.

Both data sets were standardized using the correction factors developed from the above analysis and analyzed according to the following model:

$$X_{ijklm} = \mu + Y_i + H_j + S_k + D_l + (SD)_{kl} + E_{ijklm}$$

where X_{ijklm} is the record of an individual calf for birth weight, weaning weight, grade or condition score. The other elements in the model are μ, an element common to all calves, Y_i, an effect of the *i*th year, H_j, an effect of the *j*th herd, S_k, an effect of the *k*th sire breed, D_l, an effect of the *l*th dam breed, $(SD)_{kl}$, an effect unique to the *kl*th sire breed-dam breed combination, and E_{ijklm}, an effect associated with the errors of measurement and the uniqueness of the individual calf. Mean separations was by repeated t-tests of least squares means (SAS, 1982).

RESULTS

First Data Set

The analysis of data set 1 appears in Table 4. This analysis reveals that year effects influenced birth weight, weaning weight, weaning grade and condition. Significant herd effects were observed only for weaning weight. Breed of sire effect was significant or approached significance for all traits. Breed of dam influenced birth and weaning weights and condition scores but not grade. The breed of sire by breed of dam interaction was not significant for any of the four traits.

Table 4. Analysis of Variance of Weaning Traits of Calves, 1975-78 (Data Set 1)

		Mean Squares			
Source	DF	Birth Wt. (lb.)	Weaning Wt. (lb.)	Grade	Condition
Year	3	1044**	64468	1.60*	10.75**
Herd	3	73	16990**	1.05	.51
Breed of Sire	1	474 (P = .06)	15666*	6.21**	.88 (P = .07)
Breed of Dam	4	1899**	50942**	.99	.79*
BS x BD	4	58	1006	.45	.12
Residual	245	136	3205	.56	.26

* $P<.05$.
**$P<.01$.

Table 5 reveals the least squares means for birth weight in data set 1 according to sire breed and dam breeding group. Birth weights of calves sired by Charolais and Santa Gertrudis bulls were 78.5 and 75.1 pounds, respectively. Mean separation procedures revealed that birth weight of calves from ABR, ARP and HA cows were similar with means of 70.7, 70.4 and 74.7 pounds, respectively. These procedures also revealed that birth weights of calves from HBR and HRP were similar with means of 86.6 and 81.7 pounds, respectively. The absence of a significant breed of sire by breed of dam interaction indicates that the differences among the dam breeds were similar to one another when they were mated to either of the sire breeds. The least squares means in Table 5 for dams with the sire breeds combined are illustrated in Figure 1. These means expressed as a percentage of the contemporary HA breeding group are illustrated in Figure 2.

Table 5. Least-Squares Means and Standard Errors for Birth Weight (lb.) of Calves, 1975-78 (Data Set 1)

Breeding Group of Dam	Breed of Sire: CH	Breed of Sire: SG	Overall
ABR	70.6 ± 2.3	70.8 ± 3.2	70.7 ± 2.0[b]
ARP	69.8 ± 1.6	71.1 ± 3.0	70.4 ± 1.7[b]
HA & AH	72.5 ± 1.7	77.0 ± 3.2	74.7 ± 1.8[b]
HBR	83.5 ± 2.3	89.6 ± 3.2	86.6 ± 2.0[a]
HRP	79.3 ± 1.9	84.0 ± 4.2	81.7 ± 2.3[a]
Overall[c]	75.1 ± 0.9	78.5 ± 1.5	

[a,b]Breeding group of dam means with different superscripts differ ($P<.05$).
[c]Breed of sire means differ ($P = .06$).

Table 6 shows the least squares means for weaning weight according to breed of sire and breed of dam. The calves sired by CH bulls were 19.3 pounds heavier than those sired by SG bulls. The respective weaning weights for CH and SG sired calves were 507.6 and 488.3 pounds. Heavier calves were weaned by cows that were one-half Brahman breeding. Weaning weights for calves with ABR and HBR were 526.2 and 548.4 pounds, respectively. In comparison, weaning weights for calves weaned by ARP, HRP and HA were 462.8, 477.4 and 475.2 pounds, respec-

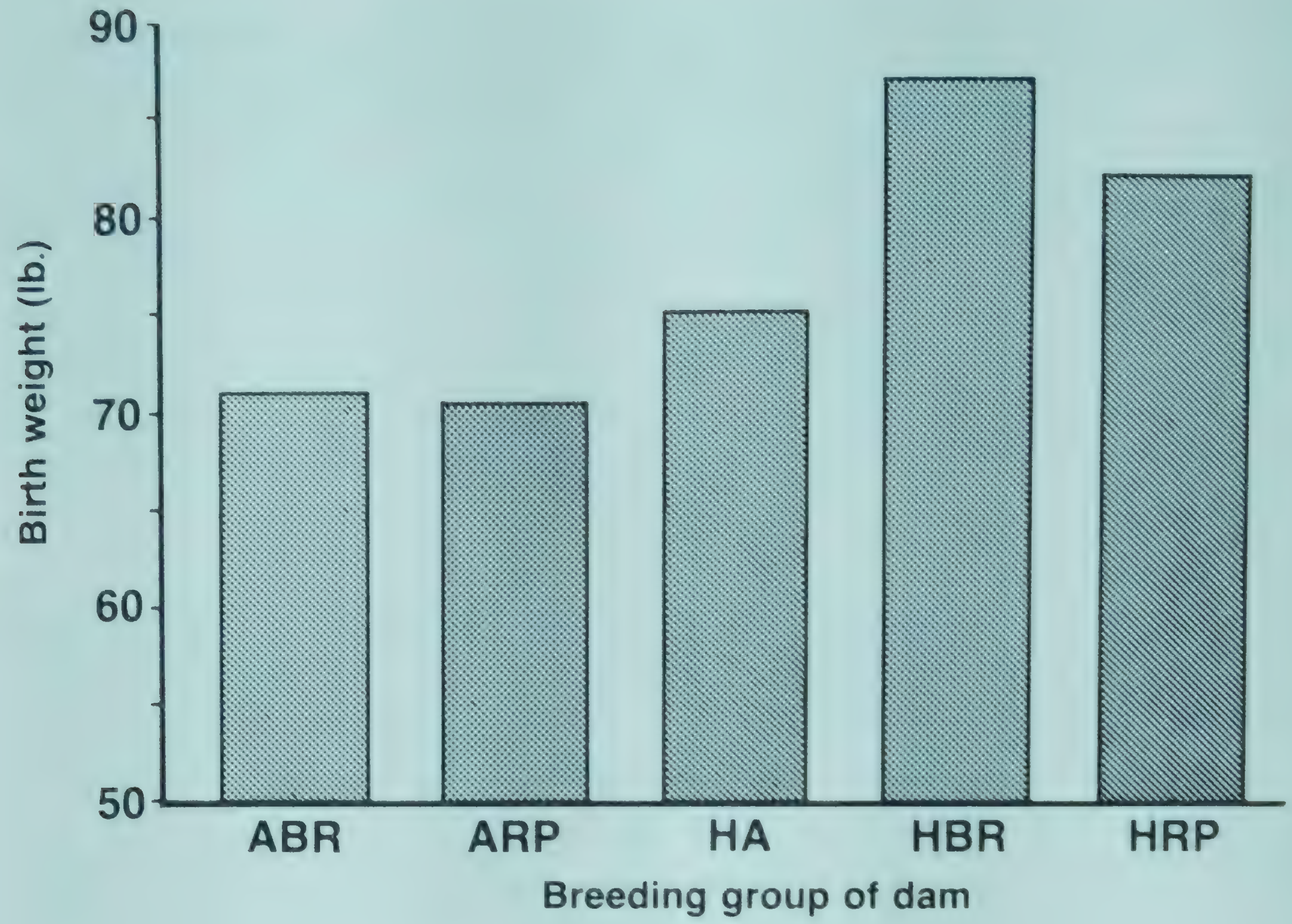

Figure 1. Least-squares means for birth weight in data set 1 by breeding group of dam.

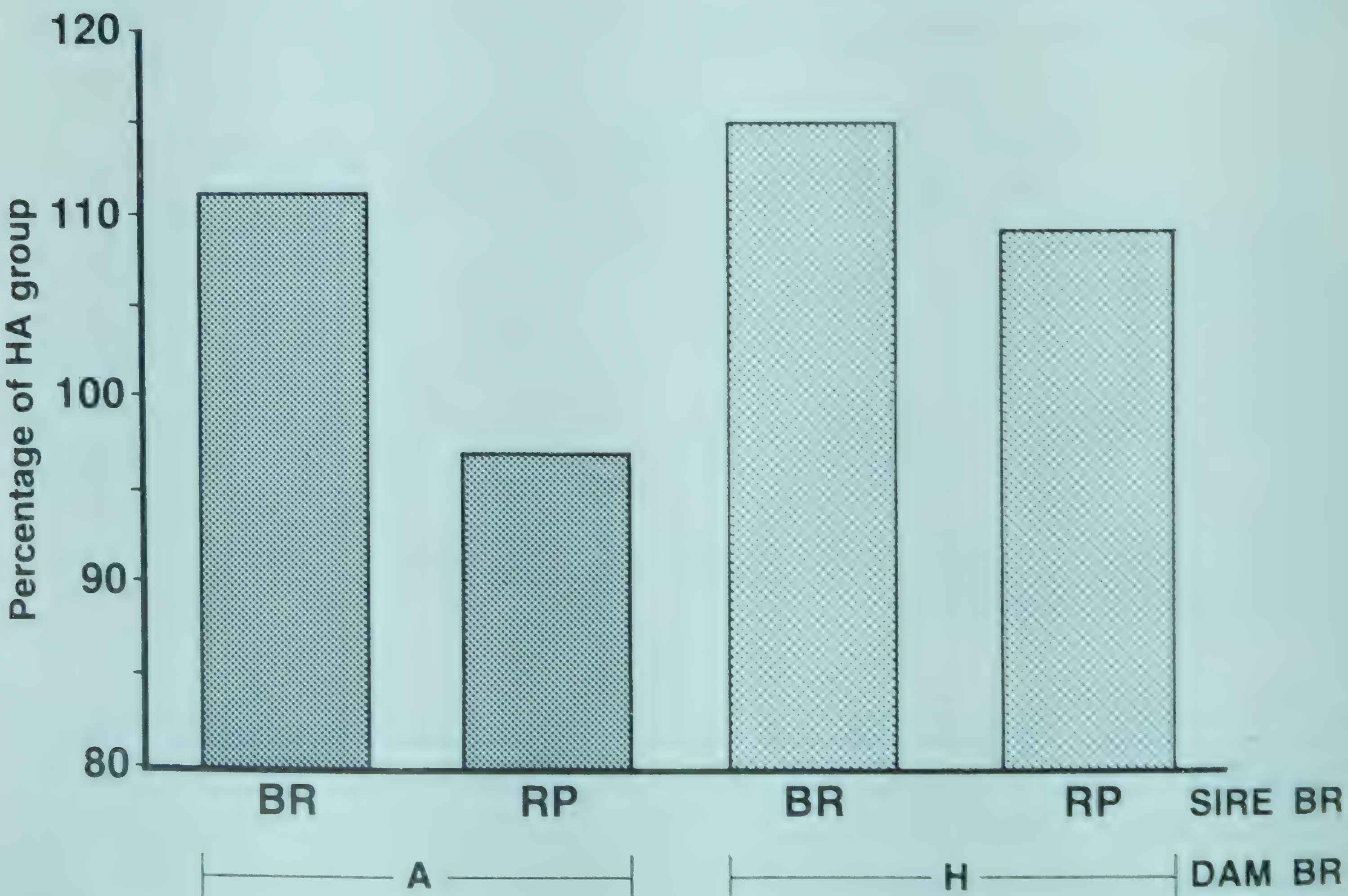

Figure 2. Comparison of F_1 dam breeding groups as a percentage of the contemporary Hereford x Angus breeding group for birth weight in data set 1.

tively. The absence of a significant breed of sire by breed of dam interaction indicates that the differences among the dam breeds were similar relative to one another when they were mated to either of the sire breeds. Least squares means of dam performance with sire breeds combined are found in Table 6, and are illustrated in Figure 3. Comparison of these dam breeds with contemporary groups is presented in Figure 4.

Table 6. Least-Squares Means and Standard Errors for Weaning Weight (lb.) of Calves, 1975-78 (Data Set 1)

Breeding Group of Dam	Breed of Sire: CH	Breed of Sire: SG	Overall
ABR	535.6 ± 11.3	516.7 ± 15.4	526.2 ± 9.7[a]
ARP	477.2 ± 7.9	448.4 ± 14.6	462.8 ± 8.3[b]
HA & AH	477.9 ± 8.4	472.4 ± 15.3	475.2 ± 8.7[b]
HBR	555.4 ± 11.1	541.4 ± 15.6	548.4 ± 9.7[a]
HRP	492.0 ± 9.0	462.7 ± 20.3	477.4 ± 11.1[b]
Overall[c]	507.6 ± 4.5	488.3 ± 7.5	

[a,b]Breeding group of dam means with different superscripts differ ($P<.05$).
[c]Breed of sire means differ ($P<.05$).

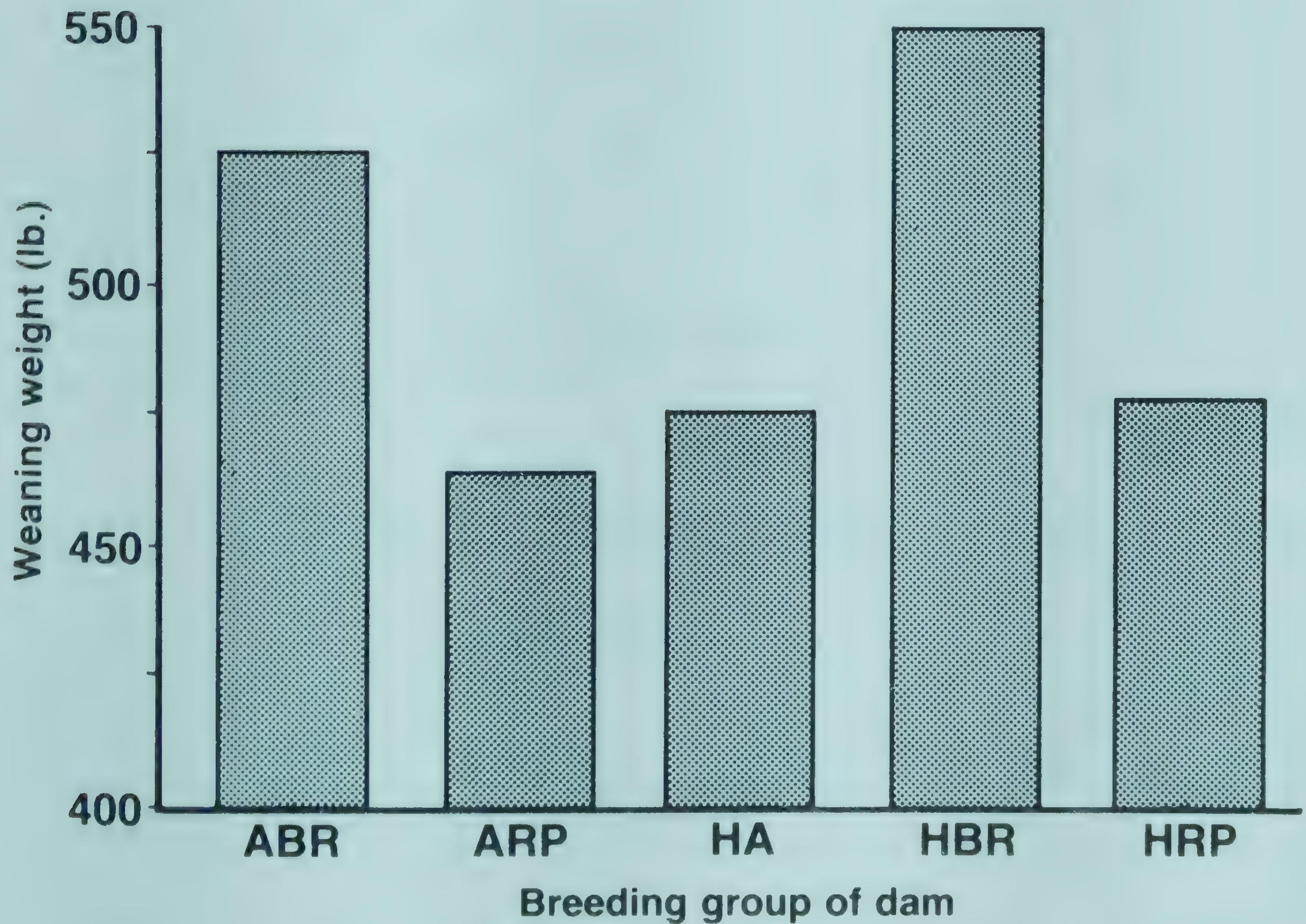

Figure 3. Least-squares means for weaning weight in data set 1 by breeding group of dam.

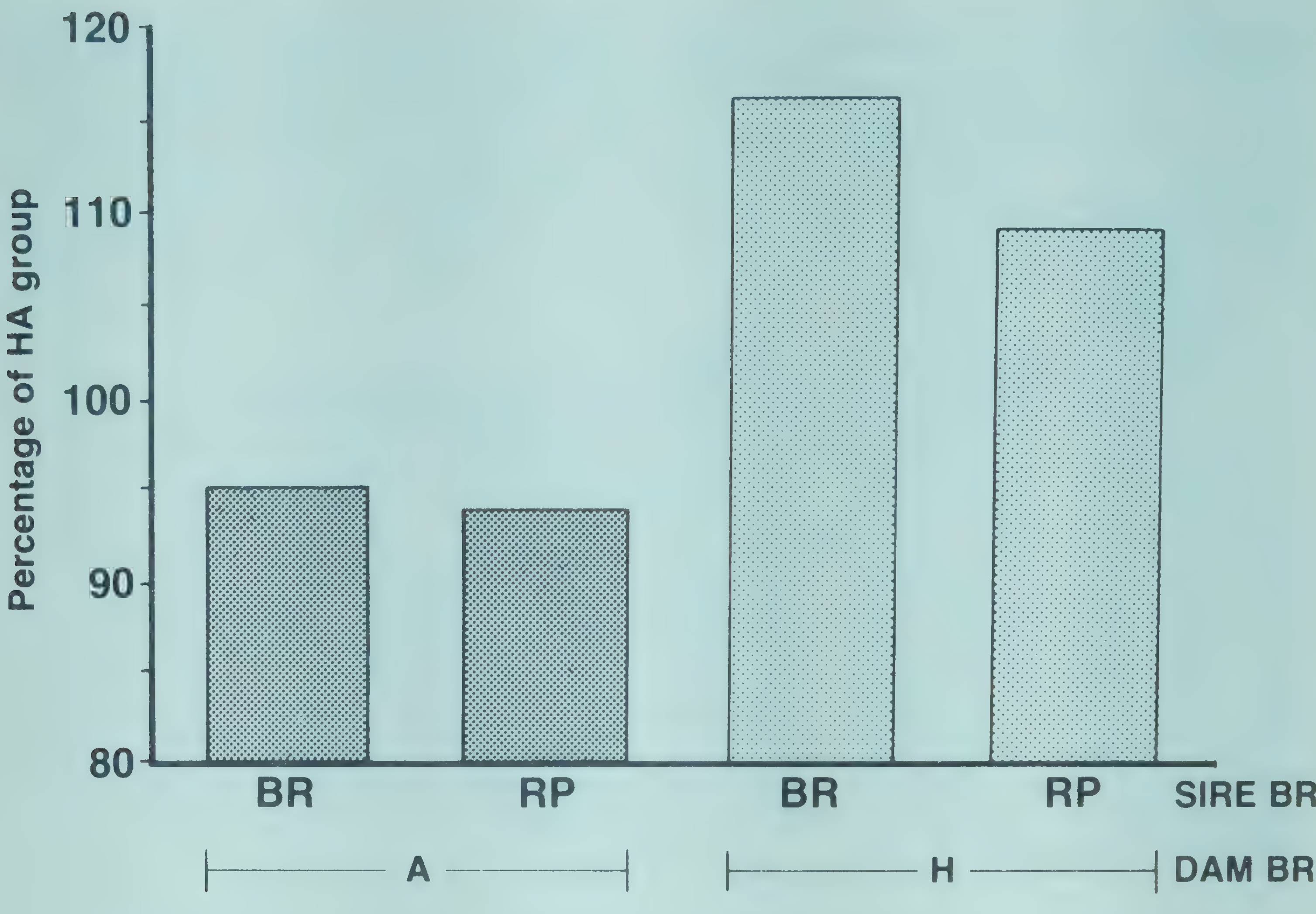

Figure 4. Comparison of F_1 dam breeding groups as a percentage of the contemporary Hereford x Angus breeding group for weaning weight in data set 1.

Table 7 gives least squares means for weaning grade of calves according to breed of sire and dam breeding group. The differences among dam breeding groups were not significant. The means of all groups were between a grade of 12 and 13, which would correspond to low and mid-choice USDA feeder grades. Sire differences were significant but the differences were less than a third of a USDA feeder grade. Both breed of sire means (12.5 and 12.1 for CH and SG, respectively) indicate calves grading low choice. These small differences in grade would not be of economic importance. Least squares means of dam performance for weaning grade with sire breeds combined are shown in Table 7.

Table 7. Least-squares Means and Standard Errors for Grade of Calves, 1975-78 (Data Set 1)[1]

Breeding Group of Dam	Breed of Sire CH	Breed of Sire SG	Overall[a]
ABR	12.9 ±.2	12.3 ±.2	12.6 ±.1
ARP	12.4 ±.1	12.1 ±.2	12.2 ±.1
HA & AH	12.4 ±.1	11.8 ±.2	12.1 ±.1
HBR	12.3 ±.2	12.2 ±.2	12.2 ±.1
HRP	12.4 ±.1	12.1 ±.3	12.3 ±.2
Overall[b]	12.5 ±.2	12.1 ±.1	

[1]Grade is indicated on a scale with values between 1 and 17 with 9, 10, and 11 corresponding to USDA Good feeder grade as described in 1975.

[a]No difference in breeding group of dam means ($P<.05$).

[b]Breed of sire means differ ($P<.01$).

Table 8 shows the least-squares means for condition scores of calves according to sire breed and dam breeding group. These means indicate small differences that are statistically significant but not large enough to be of practical importance or to influence marketing of the calves. Calves from the breed of dam groups ranged from 4.0 to 4.3 in condition scores. The sire groups were 4.1 and 4.2 for SG and CH, respectively.

Table 8. Least-Squares Means and Standard Errors for Condition Scores of Calves, 1975-78 (Data Set 1)[1]

Breeding Group of Dam	Breed of Sire: CH	Breed of Sire: SG	Overall
ABR	4.4 ±.1	4.4 ±.1	4.4 ±.1[a]
ARP	4.1 ±.1	4.0 ±.1	4.0 ±.1[c]
HA & AH	4.2 ±.1	4.1 ±.1	4.2 ±.1[abc]
HBR	4.4 ±.1	4.2 ±.1	4.3 ±.1[ab]
HRP	4.2 ±.1	3.9 ±.2	4.0 ±.1[bc]
Overall[d]	4.2 ±.1	4.1 ±.1	

[1]Condition was scored on a scale from 1 to 9 where 1 was thinnest and 9 was fattest.
[a,b,c]Breeding group of dam means with different superscripts differ ($P<.05$).
[d]Breed of sire means differ ($P<.05$).

Second Data Set

The analysis of data 2 is found in Table 9. This analysis shows that herd and year influenced weaning weight but did not influence birth weight or grade and condition scores. Breed of sire significantly influenced birth weight and approached ($P<.09$) significance for grade but did not influence weaning weight or condition score. Breed of dam influenced all traits. The interaction of breed of sire by breed of dam was not significant for any of the traits although it approached significance ($P<.08$) for weaning weight.

Table 9. Analysis of Variance of Weaning Traits of Calves, 1979-82 (Data Set 2)

		Mean Squares			
Source	DF	Birth Wt. (lb.)	Weaning Wt. (lb.)	Grade	Condition
Year	3[a]	128	74474**	1.53	.21
Herd	3	140	26723**	1.05	.28
Breed of Sire	1	1949**	411	1.98	.01
Breed of Dam	8	363**	18777**	2.26**	.64
BS x BD	8	90	4844	.94	.35
Residual	527[a]	123	2768	.68	.39

[a]Year DF = 2 and Residual DF = 456 for grade and condition.
* $P<.05$.
**$P<.01$.

Table 10 shows the least squares means for birth weight according to breed of sire and breed of dam. The breed of sire by breed of dam interaction was not significant, which indicates that breeds of dams ranked similarly when mated to the

SI and BN sires. Birth weight of calves from SI sires were heavier than calves from BN sires by 4.1 pounds. Mean birth weights of calves from these sires were 75.0 and 70.9 pounds, respectively. The mean birth weight for the nine breed of dam groups ranged from 77.3 to 68.7 pounds. The order in which the dam breed groups ranked for birth weight was ACH, HBR, HSG, ABR, ASG, HRP, HCH, ARP, and HA. Mean separation procedures suggest 4 clusters of F_1 dam breed groups that do not differ significantly for birth weight. Least squares means for birth weights of calves in Table 10 by dam group with sire breeds combined are shown in Figure 5. Comparison of these dam groups as a percentage of contemporary HA dams are shown in Figure 6.

Table 10. Least-Squares Means and Standard Errors for Birth Weight (lb.) of Calves, 1979-82 (Data Set 2)

Breeding Group of Dam	Breed of Sire: BN	Breed of Sire: SI	Overall
ABR	69.5 ±2.2	77.4 ±1.7	73.4 ±1.4[bc]
ACH	75.9 ±2.2	78.8 ±1.7	77.3 ±1.4[a]
ARP	68.8 ±2.2	73.9 ±1.9	71.3 ±1.5[cd]
ASG	67.9 ±2.2	76.3 ±1.8	72.1 ±1.4[bcd]
HA & AH	67.2 ±2.9	70.1 ±2.0	68.7 ±1.8[d]
HBR	74.8 ±2.4	76.9 ±1.7	75.8 ±1.5[ab]
HCH	70.3 ±2.6	72.5 ±1.7	71.4 ±1.6[cd]
HRP	70.9 ±2.4	72.8 ±1.8	71.9 ±1.5[cd]
HSG	72.1 ±2.8	76.4 ±1.8	74.3 ±1.7[abc]
Overall[e]	70.9 ±0.9	75.0 ±0.6	

[a,b,c,d]Breeding group of dam means with different superscripts differ (P<.05).
[e]Breed of sire means differ (P<.01).

Table 11 gives least squares means for weaning weight of calves according to breed of sire and breed of dam groups. The mean weaning weights for calves sired by SI and BN bulls were 494.3 and 496.2 pounds, respectively. The mean weaning weight of calves from the nine dam breed groups ranged from 468.2 pounds for HA

Table 11. Least-Squares Means and Standard Errors for Weaning Weight (lb.) of Calves, 1979-82 (Data Set 2)

Breeding Group of Dam	Breed of Sire: BN	Breed of Sire: SI	Overall
ABR	499.2 ±10.6	522.5 ±8.1	510.8 ±6.7[ab]
ACH	516.1 ±10.6	499.0 ±8.1	507.6 ±6.7[abc]
ARP	484.2 ±10.4	494.8 ±9.1	489.5 ±6.9[cd]
ASG	494.8 ±10.5	511.6 ±8.5	503.2 ±6.7[bc]
HA & AH	481.3 ±13.7	455.0 ±9.7	468.2 ±8.4[e]
HBR	518.3 ±11.3	527.8 ±8.1	523.1 ±7.0[a]
HCH	488.1 ±12.4	458.2 ±8.1	473.1 ±7.4[de]
HRP	479.5 ±11.5	475.4 ±8.3	477.4 ±4.1[de]
HSG	504.1 ±13.3	504.3 ±8.3	504.2 ±7.8[abc]
Overall[f]	496.2 ± 4.1	494.3 ±3.0	

[a,b,c,d,e]Breeding group of dam means with different superscripts differ (P<.05).
[f]Breed of sire means do not differ (P>.05).

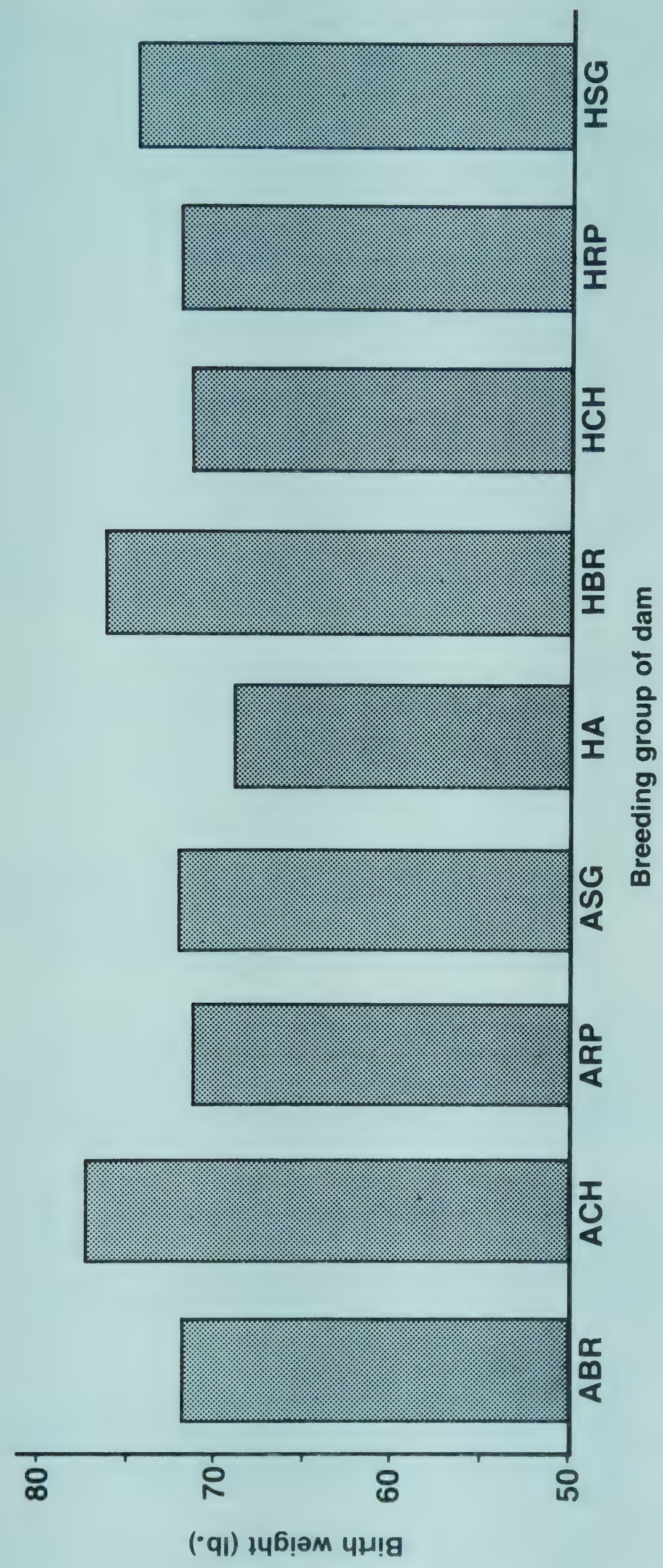

Figure 5. Least-squares means for birth weight in data set 2 by breeding group of dam.

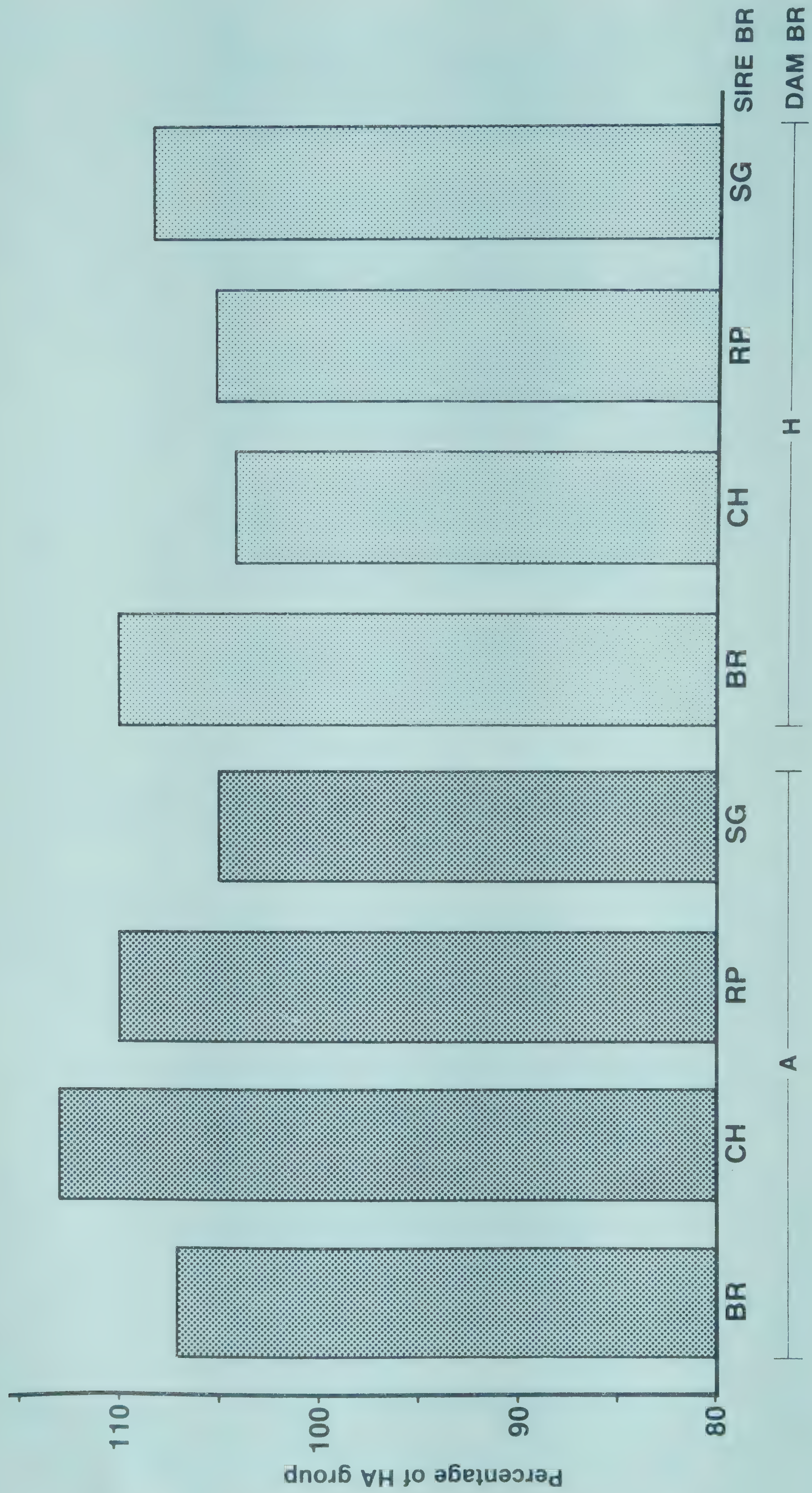

Figure 6. Comparison of F_1 dam breeding groups as a percentage of the contemporary Hereford x Angus breeding group for birth weight in data set 2.

to 523.1 pounds for the HBR. The rank order from highest to lowest of the dam breed groups was HBR, ABR, ACH, HSG, ASG, ARP, HRP, HCH and HA. Mean separation procedures suggested these could be grouped into five similar groups as indicated in Table 11. Least squares means for dam performance indicated by weaning weight of calves with breed of sires combined are illustrated in Figure 7. Comparison of dam performance for weaning weight expressed as a percentage of the contemporary HA group is presented in Figure 8.

Table 12 reveals the least squares means for grade at weaning according to breed of sire and breed of dam group. The breed of sire by breed of dam interaction was not significant. This indicates that the rank of means for dam breeds was the same when mated to SI and BN sires. Sire breed means did not differ significantly with grades of 12.1 and 12.3 for BN and SI sired calves. The range of mean grades of calves from the nine breed of dam groups was between 11.8 and 12.5. Even though the breed of dam groups differed significantly ($P<.01$), the differences were not great enough to be of practical importance. This range of means is approximately the equivalent of one-third of a USDA feeder grade.

Table 12. Least-Squares Means and Standard Errors for Grade of Calves, 1979–82 (Data Set 2)[1]

Breeding Group of Dam	Breed of Sire: BN	Breed of Sire: SI	Overall
ABR	11.8 ±.2	12.3 ±.1	12.1 ±.1[bc]
ACH	12.3 ±.2	12.6 ±.1	12.5 ±.1[a]
ARP	12.0 ±.2	12.2 ±.2	12.1 ±.1[bc]
ASG	12.3 ±.2	12.7 ±.2	12.5 ±.1[a]
HA & AH	12.2 ±.2	11.8 ±.2	12.0 ±.1[bc]
HBR	12.1 ±.2	12.4 ±.1	12.2 ±.1[ab]
HCH	12.5 ±.2	12.2 ±.1	12.3 ±.1[ab]
HRP	11.8 ±.2	11.8 ±.1	11.8 ±.1[c]
HSG	12.1 ±.2	12.3 ±.1	12.2 ±.1[ab]
Overall[d]	12.1 ±.1	12.3 ±.1	

[1]Grade is indicated on a scale with values between 1 and 17 with 9, 10 and 11 corresponding to the USDA Good grade as described in 1975.
[a,b,c]Breeding group of dam means with different superscripts differ ($P<.05$).
[d]Breed of sire means differ ($P=.09$).

Table 13 shows the least squares means for condition scores in data set 2. In this scoring system with numerical values from 1 to 9, the higher numbers indicate increasing fatness. Analysis of variance revealed that there were no significant differences between the conditions scores of calves from BN and SI sires which both averaged a score of 5.9. The breed of sire by breed of dam interaction was not significant indicating that the rank of dam breed groups on mean condition scores would be the same when mated to BN and SI sires. Breed of dam means for condition scores did not differ ($P<.05$) significantly. They ranged between 3.6 and 4.0. Least squares means for dams performance for condition scores of calves over both breeds of sires are shown in Table 13.

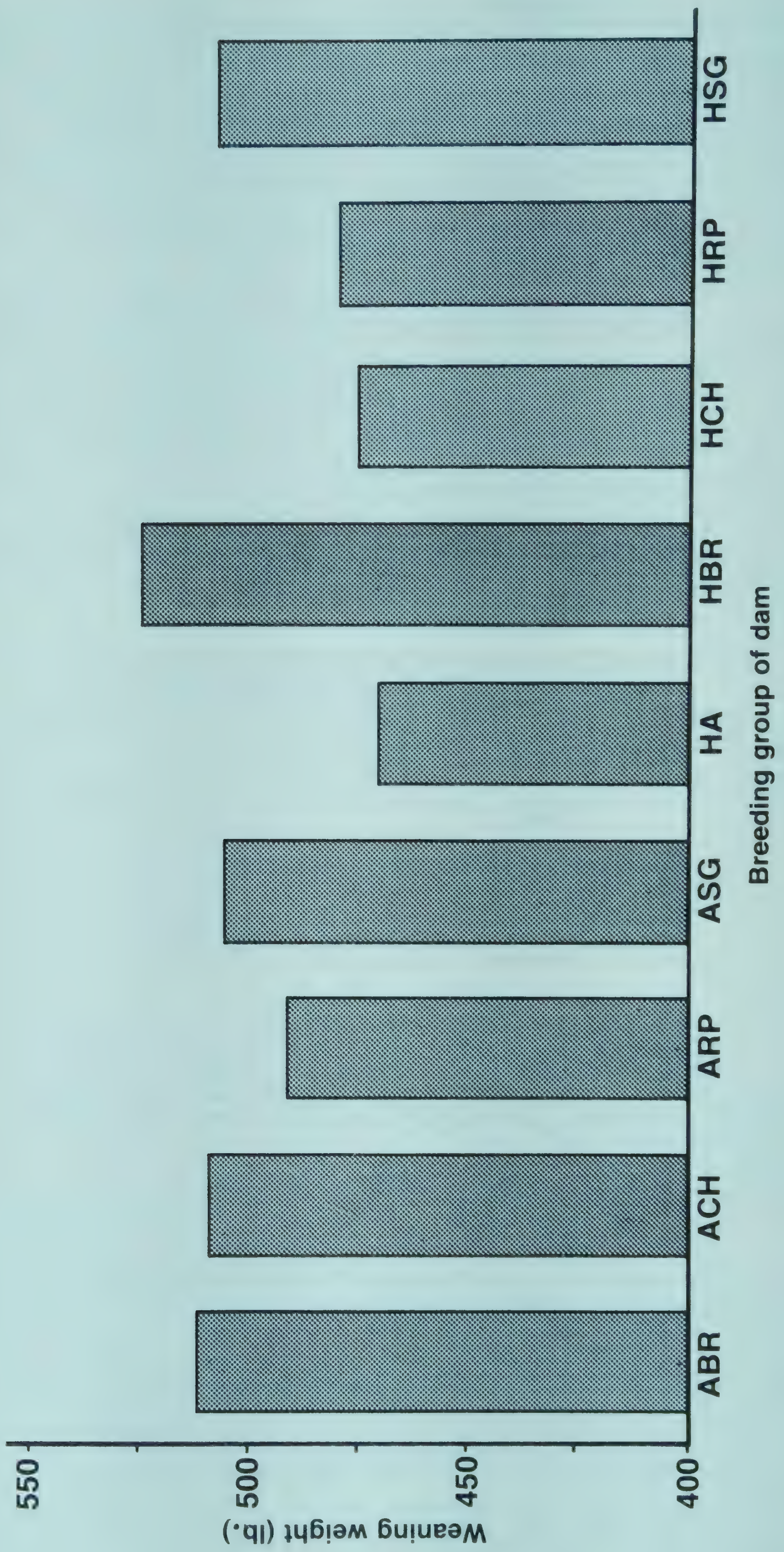

Figure 7. Least-squares means for weaning weight in data 2 by breeding group of dam.

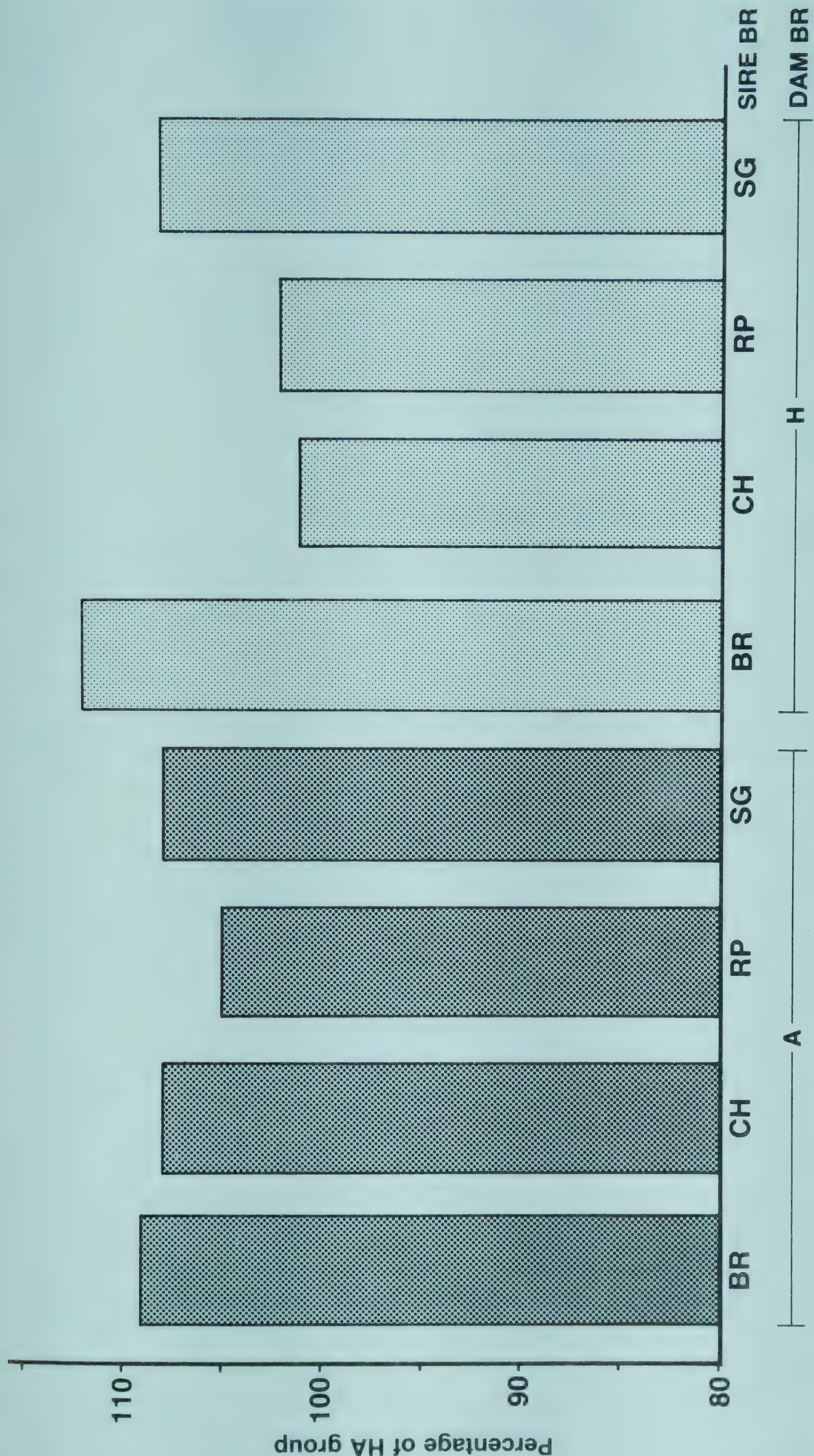

Figure 8. Comparison of F_1 dam breeding groups as a percentage of the contemporary Hereford × Angus breeding group for weaning weight in data set 2.

Table 13. Least-Squares Means and Standard Errors for Condition Scores of Calves, 1979–82 (Data Set 2)

Breeding Group of Dam	Breed of Sire		
	BN	SI	Overall[a]
ABR	3.6 ±.1	4.0 ±.1	3.8 ±.1
ACH	4.0 ±.1	4.0 ±.1	4.0 ±.1
ARP	3.9 ±.1	3.9 ±.1	3.9 ±.1
ASG	3.9 ±.1	3.9 ±.1	3.9 ±.1
HA & AH	3.8 ±.2	3.9 ±.1	3.9 ±.1
HBR	4.0 ±.1	4.1 ±.1	4.0 ±.1
HCH	4.0 ±.2	3.8 ±.1	3.9 ±.1
HRP	3.6 ±.2	3.7 ±.1	3.6 ±.1
HSG	4.0 ±.2	3.8 ±.1	3.9 ±.1
Overall[b]	3.9 ±.1	3.9 ±.0	

[a]Breeding group of dam means do not differ (P>.05).
[b]Breed of sire means do not differ (P>.05).

Observations of Competitive Mating Behavior

A secondary objective of these studies was to observe the competitive mating performance of paired bulls of two different breeds. In data set 1 the pairing was between Charolais and Santa Gertrudis bulls. In data set 2 the pairing was between Brangus and Simmental bulls. Each year for four years, four pairs of bulls were mated in four herds. The bulls were rotated so that the pairing was different each year for any individual bull. Based on color markings and breed character, calves were classified at birth according to sire. The number of calves of each breed combination are given in Table 1 and Table 2 for data set 1 and data set 2, respectively. These numbers are expressed as percentages in Table 14.

Table 14. Weaning Percentages of Various Breed Combinations, 1975–78 (Data Set 1) and 1979–82 (Data Set 2)

Breeding Group of Dam	Weaning Percent	Percentage of Calves Sired by	
		CH	SG
Data Set 1:			
ABR	53	67	33
ARP	85	76	24
HA	75	77	23
HBR	53	67	33
HRP	61	84	16
Average	65	75	25
Data Set 2:		SI	BN
ABR	85	62	38
ACH	85	63	37
ARP	76	67	33
ASG	83	61	39
HA	56	67	33
HBR	81	66	34
HCH	76	70	30
HRP	78	66	34
HSG	71	72	28
Average	77	65	35

In data set 1 the average weaning rate was 65 percent. Of the calves weaned, 75 percent were sired by Charolais and 25 percent were sired by Santa Gertrudis bulls. The percentage of calves sired by Charolais bulls ranged from 67 percent for ABR and HBR cows to 84 percent for HRP cows.

In data set 2 the average weaning rate was 77 percent. It was thought the higher weaning rate of cows in data set 2 may have occurred because the cows were older and higher rates of pasture fertilization produced more forage. Among the various groups of cows, the weaning rate ranked from a low of 56 percent for HA to a high of 85 percent for ABR and ACH cows. The comparison of SI and BN sires under conditions of competitive mating indicates 65 percent of the calves were sired by SI bulls and 35 percent were sired by BN bulls.

Observations of the behavior of bulls on pasture during the breeding season established that the SG and BN bulls were mating but they were slower to mount and serve. Because CH and SI sires had more first services, a larger percentage of the calves were sired by them in data sets 1 and 2, respectively. Since semen checks and ability to mount and serve were established for all bulls, these data indicate a need to consider mating behavior of sires in multiple sire herds if sires are to be used most effectively.

DISCUSSION

Gross return to the feeder calf enterprise is determined by the average weaning weight of calves produced, the number of calves produced and the average quality grade and condition. The first two of these production traits determines the gross weight sold and the latter two determine the selling price per pound. This study reports the production of nine groups of F_1 crossbred cows in terms of these production traits. This is the traditional basis for evaluation of the feeder calf enterprise. Such evaluation is based on output only. Evaluation of a breeding group on the basis of output only is limited because production requirements may vary among individual cows. Therefore breeding groups such as the F_1 breeding groups in this study would also vary. These differences may influence production efficiency and therefore profits.

In Arkansas, feeder calf production requires compromise at intermediate levels among the traits of mature size, maturing rate and milk production in the cow herd if best use of feed and forage resources on the farm are realized. These traits are factors that determine energy requirements. Feed and forage resources vary among farms, therefore the optimum level of these characteristics must vary as well if the best choice of cattle is made to match the feed and forage resources. How well the cow herd matches the resources or how nearly the forage resources can meet the requirements of the cattle will be reflected in the supplementary feed that must be provided. Failure to provide needed supplementary feed for a cowherd that is mismatched with the forage resource will be reflected in increased ages at puberty, reduced reproduction and weaning rates and higher maintenance costs of cows. The size and maturing rate of the parents also influence carcass leanness and marbling at acceptable market weights. How well the producer is able to match cattle and resources

influences costs of production and establishment of the reputation of a herd. In this study traditional evaluation of the crossbred breeding groups of cows is given, which has the limitation of ignoring any differences in requirements for production. Subsequent publications will address the production efficiency of the various groups.

Crossbreeding for beef production in the southern areas of the U.S. has found increasing favor as the beef cattle industry has grown and developed. Since the organization of a cooperative regional research effort concerned with methods of improving cattle in the South through breeding methods, a large number of studies on crossbreeding has been published. Reviews of this research may be found in publications by Kincaid (1962), Cunha et al. (1963), Mason (1966), Temple (1966), Warwick (1968), Cundiff (1970), Koger, et al. (1973), Franke (1979) and Long (1979a,b). A series of papers by Gregory et al. (1978a,b,c,d,e) on heterosis and breed, maternal and transmitted effects, and the breed characterization studies at the Meat Animal Research Center in Clay Center, Nebraska by Gregory et al. (1979) have contributed to knowledge concerning utilization of various breeds in systematic crossbreeding programs.

The above reviews indicate that heterosis is greatest for traits of low to moderate heritability. These include early growth rate of the calf, maternal ability of the cow and measures of fertility influencing calf crop percentage. Cundiff et al. (1970) indicated that production per cow exposed for breeding can be increased 20 to 25 percent by systematic crossing of the British breeds. Results of crossbreeding studies with Charolais, although not as numerous or consistent as those with British breeds, suggest greater additive genetic influences on these traits and smaller heterosis effects from non-additive gene effects (Klosterman et al. (1968), Pahnish et al. (1969, 1971), Lashley et al. (1973), Sagebiel et al. (1973, 1974), Brown et al. (1975), Long et al. (1979a,b), Alenda et al. (1980) and Dillard et al. (1980).

The increase in weaning weight of crossbred calves and in calves from crossbred cows involving Brahman-Hereford crosses were reported by Cartwright (1964). He estimated heterosis for growth of first cross calves at 15.9 percent and the effect of maternal ability of crossbred dams at 9.5 percent. Koger (1975a,b) estimated a 41.5 percent increase in total production efficiency from a survey of literature on Brahman-European crosses. Similar results of crossing breeds based on Brahman-British (Santa Gertrudis, Brangus) crossbred foundations have been reported by Damon et al. (1959a,b, 1960, 1961) and Turner (1969).

Turner et al. (1968), Turner and McDonald (1969), Peacock et al. (1978, 1979, 1981), Gregory and Cundiff (1980) have discussed the optimum use of crossbreeding systems to utilize breed differences and heterosis effects for beef production.

CONCLUSIONS

Maternal performance of nine different F_1 dam groups are presented for four traits. The traits are birth weight, weaning weight, weaning grade and weaning condition.

The nine F_1 dam groups were: Angus-Brahman (ABR), Angus-Charolais (ACH), Angus-Red Poll (ARP), Angus-Santa Gertrudis (ASG), Angus-Hereford or Hereford-Angus (HA), Hereford-Brahman (HBR), Hereford-Charolais (HCH), Hereford-Red Poll (HRP), and Hereford-Santa Gertrudis (HSG).

A summary of the comparisons made among the F_1 dam groups are as follows:

1. HBR cows produced calves weighing 10 to 16 percent more at birth and 12 to 15 percent more at weaning than HA cows.
2. ABR cows produced calves weighing 95 to 107 percent of the weight of HA cows at birth and calves weighing 9 to 11 percent heavier at weaning.
3. The weaning weights of the other F_1 crossbred dam groups in this study were between those of HBR and HA. Means for HSG, ACH and ASG dam breed groups were similar and exceeded HRP and ARP.
4. Small differences in grade and condition among the dam breed groups were not large enough to be of economic importance.
5. Observations of competitive mating behavior of CH vs SG and SI vs BN sires in producing 3–breed cross calves from the above crossbred cows favored the CH and SI sires for number of calves sired but there were no difference in the sire comparisons for weaning weight of calves.

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